Module 3 and 4: Core surgical skills and postoperative care

Scope

- **At the end of the module you should be able to answer questions on:**
- Complications of surgical procedures and their prevention. This includes:
    - Preoperative, intraoperative and postoperative care
    - Surgical site infections and their control
    - Venous thromboembolism and its prevention
- Problems with the obese patient
- The names and use of common surgical incisions, instruments and sutures
- Safety issues in laparoscopy and hysteroscopy
- Knowledge on the use and complications of diathermy and other energy sources including laser

Peri operative care

The first step: taking a consent

- The details have been covered in Modules 1&2. But the essentials may be highlighted as:
- The best procedure for that particular patient must be selected
- The consent must be informed and it is the operating surgeon that must obtain it
- Both benefits and risks must be disclosed
- Adequate time for reflection must be given to the patient

Some practical points in preoperative care

- **Smoking** must be stopped at least **24 hours** before surgery:

  Why? because of the cardiovascular complication of nicotine and the effect

  of carboxyhemoglobin on oxygenation
- If she has been on **oral contraceptives** it must be stopped at **least 1 month** before a major surgery
- If she has had a **myocardial infarction**, surgery should be delayed for at **least 6 months:** evidence shows that at least a third will re-infarct within 3 months and the risk reduces to 4% after 6 months (BMJ 1982)
- If she is a black patient the routine testing for sickling has not been shown to be cost effective especially if she is sickle cell trait

Preoperative care (continued)
How does one reduce surgical site infections?
Source NICE (NG125; 2019)

Prevention of surgical site infections :

- Shower or bath with soap within 24 hours or on the day of surgery. If there is a high risk of *Staph. aureus* infection have a body wash with chlorohexidine
- If there is a high risk of *Staph aureus* infection, consider nasal application of mupirocin
- Routine hair removal is not recommended. If hair removal is done use electric clippers. Avoid razor removal because it increases the risk of infection
- Patients undergoing elective surgery should be screened for MRSA. If present or if there is evidence of past infection, they should undergo skin decolonization with skin wash. For antibiotic prophylaxis, IV teicoplanin or vancomycin is given

Antibiotic prophylaxis before surgery:

- The use of single dose prophylactic antibiotics given IV and *before the incision is made* is recommended
- NB: prolonged use of antibiotics may be associated with *Clostridium difficile* infection

What are the steps in prophylaxis against DVT?

NICE clinical guideline 92.

On admission do an assessment for the risk of thromboembolism in the patient. Follow three steps:

- **Step 1:** Assess the degree of mobility. If reduced or prolonged, it is a indication for prophylaxis
- **Step 2:** Review the patient-related factors shown on the assessment sheet for thrombosis risk,
- Any tick for thrombosis risk should prompt thromboprophylaxis and these include:

1. active cancer or cancer treatment, 2. age > 60, 3. dehydration, 4. known thrombophilia 5. obesity (BMI > 30) 6. one or more significant medical co-morbidities 7. personal history or first-degree relative with a history of VTE 8. use of hormone replacement therapy or COC 9. varicose veins with phlebitis 10. pregnancy or < 6 weeks post partum

- **Step 3:** Balance the risk of DVT against the risk of bleeding in the patient.

The risk for bleeding include: 1. active bleeding 2. acquired bleeding disorders (such as acute liver failure), 3. concurrent use of anticoagulants known to increase the risk of bleeding (such as warfarin with INR >2), 4. acute stroke 5. thrombocytopenia (< 75) 6. uncontrolled hypertension 7. untreated bleeding disorders e.g. haemophilia

- Then make a clinical judgement
- Drug of choice is low molecular weight heparin

The Obese patient: The take home points:
Source: Surgical risk from obesity in gynaecology. TOG 2011;13: 87

- A BMI of 35 per se is a poor predictor of risk unless associated with comorbidities. But a BMI of 40 or > is by itself a risk
- Consider conservative measures first before embarking on surgery e.g. pessary for prolapse, Mirena for menstrual problems
- Problems that must be anticipated are:

1. comorbidities such as hypertension, diabetes, IHD, atrial fibrillation irrespective of IHD. Note that these comorbidities must be dealt with prior to surgery.
2. obstructive sleep apnea: a room air pulse oximetry < 96 is indicative
3. increased risk of infection
4. increased risk of DVT

The Obese patient: The take home points: (cont)

Source: Surgical risk from obesity in gynaecology. TOG 2011;13: 87

- There is a need for thromboprophylaxis because venous stasis, increased fibrinogen and factor VIII are raised in these women. LMWH e.g. enoxaparin 40 mg daily started a minimum of 2 hours postoperatively, and continued for 1 week after surgery but extended to 4 weeks in cases of pelvic surgery for malignancy.
- Prophylactic antibiotics (single dose of IV antibiotics) should be given before incision made
- Perioperatively, special precautions must be taken to prevent falls off the table and during transfer. Apply pads to prevent risk of nerve injury and of rhabdomyolysis of the gluteal muscles leading to renal failure if surgery is prolonged
- Laparoscopic surgery: it is not an absolute contraindication but disadvantages are failed entry, poor vision, respiratory compromise. Advantages include less ileus, less wound infection and early mobilisation. For entry of Verres needle open (Hasson) technique or entry at the Palmer's point is recommended
- For open surgery, mass closure techniques using delayed absorbable sutures placed 1 cm from the edge of the rectus sheath and 1 cm apart without undue tension is recommended

The operative phase

Operative phase
Source: NICE guideline NG125; 2020

- Use surgical check-lists if available

Care for the incision wound:

- For antiseptic skin preparation: use *alcohol based chlorhexidine solutions*

  use 0.5 or 2% chlorhexidine in 70% alcohol combination as first choice

  If mucous membrane involved, use a 4.0% aqueous of chlorhexidine (Hibiscrub)
- As an alternative, 10% povidone-iodine alcoholic solution may be used
- For closure, antimicrobial triclosan-coated sutures, should be used to reduce the risk of surgical site infection.
- Consider using sutures rather than staples to close the skin after Caesarean section to reduce the risk of superficial wound dehiscence.
- For postoperative care. Use sterile saline for wound cleansing up to 48 hours after surgery. Advise patients that they may shower safely 48 hours after surgery. Use tap water for wound cleansing after 48 hours if the surgical wound has separated or has been surgically opened to drain pus.
- No evidence to support the use of intraabdominal drains unless there has been ureteric injures that have undergone repair

Post operative care

Identifying the patient at risk: using an objective system

- Modified early warning systems (MEWS) are now well established in most hospitals and a "track and trigger" system has been developed to compute the score and trigger a warning to the medical personnel: as recommended by NICE in 2007 (*NICE Clinical Guideline No. 50.)*Given below is a summary of its features i.e. the 5 areas of monitoring and their respective scores
- Note that a computed score or >5 has been associated with a risk of admission to intensive care or death

Score	3	2	1	0	1	2	3
Systolic BP (% above or below normal)	<45	30	15	normal	15	30	>45
Heart rate		<40	41-50	50-100	101-110	111-129	>130
Respiratory rate		<9		9-14	15-20	21-29	>30
Temperature		<35		35-38.4		>38.5	
AVPU alert, voice, pain, unresponsive				Alert	Reacts to voice	Reacts to pain	Unresponsive

Fluids regimes for postoperative care as recommended by NICE Clinical Guidelines 174 (updated 2016)

Maintenance regime for IV fluids

The normal daily fluid and electrolyte requirements are:

- 25–30 ml/kg/day of water
- 1 mmol/kg/of sodium, potassium, chloride
- 50–100 g/day of glucose (e.g. glucose 5% solution contains 5 g/100ml)
- Note that oliguria is diagnosed if the urine output is < *20mL/hour* in each of *consecutive 2 hours*

Fluids regimes for postoperative care as recommended by NICE Clinical Guidelines 174 (updated 2016)

The compromised patient and those in need for fluid resuscitation

Indicators that a patient may need fluid resuscitation include:

- 1. systolic BP <100mmHg; 2. heart rate >90bpm; 3. capillary refill >2s or peripheries cold to touch; 4. respiratory rate >20 breaths per min; 5. MEWS score ≥5; 6. 45 degrees or less for passive leg raising test. If present, the steps to take are:
- Firstly, identify the cause of deficit and respond accordingly
- Next, give a fluid bolus of 500 ml of crystalloid containing sodium in the range of 130–154 mmol/l and in less than15 minutes
- Then reassess patient: does the patient still need further fluid resuscitation?
- If **yes** continue till 2000 ml of fluids has been given. If **no** give a further bolus dose of 250 to 500 mls.
- If there is poor response seek expert help

Venous thromboembolism

The patients particularly at risk include:

- Total anesthetic or surgical time of > 90 mins
- If surgery involves pelvis and lower limbs and total anesthetic and surgical time is > 60 mins
- If acute surgical admission with inflammatory or intra-abdominal conditions e.g. PID
- If expected to have significant reduction in mobility
- If any VTE risk factor present (see earlier slide on prophylaxis for DVT)

Once prophylaxis has been started it should *continue for 28 days* following any major surgery

Venous thromboembolism: the pregnant patient

Source: Thromboembolic Disease in Pregnancy and the Puerperium: Green-top Guidelines 37B 2015

- **In pregnancy**:
- Any woman with symptoms and/or signs suggestive of VTE should have objective testing performed expeditiously and treatment with low-molecular-weight heparin (LMWH) given until the diagnosis is *excluded by objective testing*. D-dimer testing need not be performed in the investigation of acute VTE in pregnancy.
- Pulmonary embolism
- In women with *suspected PE* without symptoms and signs of DVT, a ventilation/perfusion (V/Q) lung scan or a computerised tomography pulmonary angiogram (CTPA) should be performed.
- When the *chest X-ray is abnormal* and there is a *clinical suspicion of PE*, CTPA should be performed in preference to a V/Q scan.
- Consideration should be given to the use of newer anticoagulants (fondaparinux, argatroban or r-hirudin) in pregnant women who are unable to tolerate heparin (LMWH or unfractionated heparin) or danaparoid

Care for the wound post operatively

Note that at least 5% would develop a surgical site infection and

The most common source for infection is the patient herself

- Use sterile saline for wound cleansing up to 48 hours after surgery
- Advise patients that they may shower safely 48 hours after surgery.
- Use tap water for wound cleansing after 48 hours if the surgical wound has separated or has been surgically opened to drain pus
- Topical antimicrobial solutions or EUSOL should not be used for wound cleansing

Postoperative analgesia

- There is an ascending order in the type of drugs available:

  from paracetamol to NSAIDS to Patient Controlled Analgesia to epidural
- Care must be taken with opioids: respiratory depression and respiratory acidosis. The appropriate antidote is naloxone
- Given is a typical blood gas picture in a patient with respiratory acidosis

	Values	Normal	interpretation
pH	7.27	7.35 -7.45	low
$PaCO_2$	7.2	4.5 -5.8 kPa	high
HCO_3	24	23 – 28 mmol/l	normal
pO_2	10.4	12.5 – 14.3 kPa	low
O_2 saturation	79%	98 %	low

Looking out for " bed sores"

- The first signs is a *reddened, discoloured or darkened area*. It may feel hard and warm to the touch. The so-called "dark-spot"
- Note however that the darkened area sign may not have visible blanching. Look for other signs like colour changes or hardness when compared to surrounding areas.
- Do the blanching test i.e. press on the red, pink or darkened area with your finger. The area should go white; remove the pressure and the area should return to red, pink or darkened colour within a few seconds. If it stays white, then blood flow has been compromised and the sore has begun.
- To confirm if a pressure sore has begun, remove pressure from the reddened area by turning the patient over for 30 minutes and the skin colour should return. If it does not the sore is present

Stages of ulcers:

- Stage 1: skin is intact but is red or discoloured or may have hardness or temperature compared to surrounding areas.
- Stage 2: The epidermis and dermis is broken, with a shallow open sore.
- Stage 3: wound extends through the dermis and unto the fatty tissue. However, bone, tendon and muscle are not visible
- Stage 4: bone and muscle is exposed

Dealing with sepsis

The Sepsis 6 Bundle or criteria was developed by the UK Sepsis Trust to help manage patients with sepsis in order to reduce its morbidity and mortality. The treatment must be instituted within **3 hours of suspicion of sepsis**

The 6 aspects are:

- Give high-flow oxygen via non-rebreathe bag
- Take blood cultures and consider source control
- Give IV antibiotics according to local protocol
- Start IV fluid resuscitation with Hartmann's or equivalent
- Check lactate levels (*rises due to endogenous epinephrine stimulating beta-2 receptors that up-regulates glycolysis, generating more pyruvate than can be used by the cell)*
- Monitor hourly urine output closely; consider catheterisation
- In addition, provide critical care support

A word about nosocomial infections

The Types

- Urinary tract infection (35%)
- Surgical site infections(17%),
- Blood (14%,)
- Pneumonia (13%)

The common Organisms:

S aureus, P. aeruginosa, E. coli, Klebsiella, Acinetobacter, Enterobacter, Enterococcus

Common Sources:

- Droplet: influensa, mycobacterium
- Aerosol(air conditioners, ventilators): gram negative hospital acquired pneumonia (pseudomonas), Legionella,
- Contact: MRSA, Group A strep, Clostridium difficile, Pseudomonas aeruginosa
- Urinary catheters: E coli; Pseudomonas aeruginosa

Antibiotic prophylaxis for abdomino-pevic surgery:

- Co-amoxiclav is recommended for abdomino-pelvic surgery. A stat intravenous dose is given 30 mins before surgery.
- Redosing is given if prolonged surgery or if there is significant blood loss

Incisions, closures and sutures

Incisions and sutures on Obstetrics and Gyanecology

Source: TOG. Abdominal incisions and sutures in obstetrics and gynaecology.2014:16: 13

Incisions:

There are two basic types in Gynaecology: transverse and midline

- Advantages of transverse incisions (as opposed to midline)are: good cosmetic results, less painful post-op, post-op respiration is affected less, provides for greater strength
- Disadvantages of transverse incisions : time-consuming to open, more bleeding, upper abdomen exploration compromised, creation of potential spaces in abdominal facial planes for hematoma formation.

Types of transverse incisions:

- Pfannenstiel incision: low transverse, no splitting of rectus sheath
- Cherney incision: transection of the rectus muscles at their insertion on the pubic symphysis and retraction upwards
- Maylard: rectus cut transversely and epigastric vessels ligated. Note that the risk of lower extremity ischaemia is there
- Joel-Cohen (high Pfannenstiel) : rectus muscles separated vertically

Closure techniques: the take home points

Source: TOG. Abdominal incisions and sutures in obstetrics and gynaecology.2014:16: 13

Mass versus layered closure:

- Mass closure technique using looped delayed–absorbable suture, with a wound to suture length ratio of at least 1:4 is favoured
- In transverse incisions, the substance of the external and internal oblique muscles is cut and injury to the ilohypogastric and ilioinguinal nerves can therefore occur and with resulting neuroma. Care must be taken not to include these nerves by placing sutures only to the external oblique fascia.
- The primary incision for laparoscopy should be vertical from the base, not below the umbilicus. Any non-midline port >7 mm and any midline port >10 mm requires formal deep sheath closure to avoid hernia.

Summary of the types of sutures used and their characteristics

Adopted from: TOG. 2014;16:13

Suture type	Filament type	Tissue reaction	Tensile strength	Absorption in days	Handling
Absorbable					
Catgut	twisted	moderate	Poor	80	
Polyglycolic acid (Dexon)	braided or monofilament	low	good	80-120	
Polyglactin (Vicryl)	braided	low	good	60-90	
Polydioxanone (PDS)	monofilament	low	greatest	120-210	
Non absorbable					
Silk	braided or twisted	high	low		good
Nylon	monofilament	low	high		poor
Polyester (Marceline)	braided	low	high		good

Staples both absorbable and non absorbable are available: they provide high tensile strength, low tissue reactivity, better than sutures for infected wounds but disadvantages include tract formation for bacteria and discomfort during removal

Laparoscopy and hysteroscopy

Laparoscopic surgery: what are the safety issues?

Source: Preventing entry-related gynaecological laparoscopic injuries.
RCOG: Green Top Guidelines 49: 2008

The risks of laparoscopy include:

- Between 1 in1000 to 12.5 in1000 for all complications.
- For bowel injury: 0.4 to 3 per 1000 but with open techniques it is still 0.6. per 1000.
- For vascular injury 0.2 to 1 per 1000

Those at risk are:

- The obese patient
- Those significantly underweight
- Those with previous midline abdominal incisions and
- Those with peritonitis or inflammatory bowel disease are at risk.
- Note that even with no previous surgery, bowel adhesions are present in 0.5% of patients. In patients with previous surgery it goes up to 20% in those with low transverse incisions and up to 50% in those with a midline incision.

Laparoscopic surgery: what are the safety issues? (cont)

Source:Preventing entry-related gynaecological laparoscopic injuries.
RCOG: Green Top Guidelines 49: 2008

Entry of Verres needle: the practical points:

- The operating table should be horizontal (not in the Trendelenburg tilt) before insertion of the Verres needle.
- the Verres needle is inserted at right angles to the skin. Two audible clicks are usually heard. Excessive lateral movement of the needle should be avoided. The most valuable sign to observe that ensures entry, is the initial insufflation pressure flow (*should be less than 8 mmHg)* and is flowing freely. An intra-abdominal pressure of 20–25 mmHg should be used for gas insufflation before inserting the trocar

The Hasson (open)technique or insertion at Palmer's point is recommended for women who are very thin

- Entry at Palmers point (3 cm below the left costal margin in the mid-clavicular line) is an alternative method to view the presence of adhesions around the umbilicus *before* entry of trocar

For secondary ports, the inferior epigastric vessels should be visualised before entry and the ports must be removed under direct vision to ensure no bleeding is present

Hysteroscopy: what are the safety issues?

- Water *must not* be used as medium. Use CO_2, saline or glycine
- Non-conductive medium is to be used if monopolar electrosurgery is used e.g. glycine
- Complications include uterine perforation or fluid absorption. Effects include hyponatremia and hypo-osmolality which gives nausea, vomiting, seizures, coma or very rarely, death.
- Fluid absorption occurs when the intrauterine pressure exceeds the mean arterial pressure (MAP) Care should be taken to monitor the height of the bag in order not to exceed the MAP
- Accurate measurement of the " fluid deficit " must always be monitored to alert the surgeon of either a perforation or absorption of fluid

Electrosurgery and lasers

Use of diathermy: the practical points

- Diathermy machines convert low frequency (50 Hz) current to high frequency (200kHz to 3.3 MHz)
- In low frequency, cyclical polarization and depolarization of cells occurs. This causes neuro-muscular stimulation (harmful)
- In high frequency, collision of intracellular ions produce heat. There is no neuro muscular stimulation (advantage and safety). The downside is the heat produced

The desired effects of the diathermy is dependent on:

- the current density (the smaller the electrode, the greater the intensity e.g. diathermy needle). Conversely, the bigger the electrode less the intensity (e.g. return pads)
- Resistance in the tissues: this is inversely proportional to its water content
- The waveform used
- Duration of activation

Monopolar and bipolar electrocoagulation : features and safety

Monopolar diathermy	Bipolar diathermy
Electric current from electrode tip (small area)through the body and back to generator via a return plate (relative wide area)	Current flows between forceps tips with intervening tissue as conducting medium
Coagulation and cutting possible	Provides coagulation only
Smaller the tip (whether needle or ball), greater the heating effect	
Hazards: • Burns at return plate if contact poor • Direct coupling occurs when electrode is in contact with another conducting instrument e.g. retractor, ECG electrodes • Capacitative coupling can occur between electrode and conducting instrument though separated by an insulator e.g. wire wrapped around instruments • Alcohol solutions: inflammable; causes burns	Minimal hazard

Differences between cutting and coagulation diathermy

	Cutting	Coagulation
Current flow	Current flows all the time	Current flows in bursts: 6% of time
Voltage	Low voltage (750 volts)	High voltage
Method	Produces heat and vapourises tissue	Heats slowly and chars tissue In fulgration: current sparks across from point to tissue surface
Effect	Vapourises, cuts or desiccates No haemostasis	No vapourisation, Coagulates and haemostasis only Fulgration: coagulates and chars tissue

Sources of diathermy damage in laparoscopic surgery

- Coupling: two kinds

1. Direct coupling: failure of insulation

2. Capacitance coupling: note that the separation media between two conductors will form a capacitor. Insulated laparoscopic equipment and a metal port form a capacitator and is capable of discharging a current. Plastic ports reduce this complication but bowel is not protected because it can act as a second conductor by itself.

The main reasons for coupling are due to:

- Failure to check the appropriate settings
- Use of spirit based solutions contribute to burns

Lasers in gynaecological surgery

- The types used are named according to the medium that is activated e.g. CO2, argon, YAG
- Basically, photons (energy) is emitted when electrons are displaced by the beam. These photons in turn stimulate identical photons with a similar wavelength and color. This causes stimulated light photons(electromagnetic radiation)onto the tissue
- The characteristics of the various kinds of lasers are summarized below:

	Wavelength	Colour	Depth of penetration
CO_2	10,600 nm.	infra-red	0.1 mm
Argon	488 - 512	blue green	0.5 mm
KTP-532	532	green	1-2 mm
Nd-YAG	1064	infra-red	3-4 mm

KTP: Potassium titanyl phosphate *Nd: YAG: neodymium doped: yttrium aluminium garnet*

Factors that determine laser–tissue interaction

- The power or wattage used
- The spot size (the closer -the smaller)
- *The power density (watts /cm2)i.e. combines* power and spot size
- The laser-tissue contact time

Types of lasers used: their advantages and disadvantages

	Gas : CO_2 and argon	**Solid- state: Nd-YAG and KTP-YAG**
	Vapourises tissue rich in water or haemoglobin	Vapourises, cuts and coagulates
Advantages	• Coagulates as it vapourises • Limited penetration • Safe: lateral damage less, good in unsafe areas • Less power settings	• Deep penetration e.g. good cutting and vapourisation • No plume (good visibility) • Easy to use: flexible fibro-optics
Disadvantages	• Cumbersome to use • Plume or smoke can affect visualisation	Deep and lateral damage more common. The beam must therefore be focussed
Uses	Endometriosis, colposcopy	Hysteroscopic, laparoscopic surgery

Thank you